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J. L. PARSONS

C. J. WILLARD

OHIO AGRICULTURAL EXPERIMENT STATION - - WOOSTER, OHIO

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Forage crops—those grown for hay, pasture, silage, cover crops, and green manure—are among the most important crops in Ohio agriculture. This report clearly demonstrates that there are differences among varieties of each crop and that the choice of variety can be as important with forage crops as with any other crop.

The purpose of these tests was to determine the response of each forage variety in the several soil and climatic regions within the state. Climatic factors are closely related to the prevalence of diseases and insects. The expense of seedbed preparation, fertilization and planting can be lost if an adapted variety is not planted.

Alfalfa variety tests were first conducted at Wooster in 1908. Red clover strain testing was begun in Ohio in 1923 and has continued at one or more locations in the state since. In any single year the number of successful test plantings are limited. Therefore, the use of those test results are limited. It is the purpose of this report to bring together the test results of several seasons, and therefore provide a sound basis for making forage crop variety recommendations.

This report includes test results since 1942 for alfalfa and 1944 for red clover. In each case the test was planted in a randomized block design with two or more replications. In most cases lime and fertility levels were maintained at near optimum levels.

In most trials, the yield results are from plots planted to only alfalfa or red clover. This practice is believed necessary to obtain the relative yield potential of the varieties. It should not be interpreted as meaning such a practice is recommended for farm conditions. In most cases the harvest dates were determined by weather and growth conditions of the crop.

PRESENTATION OF DATA

The data for each species are presented in Tables I and II in the Appendix. The discussions of alfalfa and red clover are presented in separate sections.

In order that differences in yield due to location can be minimized, the discussion is based largely on a comparison of each variety against a standard variety that appears in each test. Without such a standard basis for comparison it would be difficult to compare the same varieties in tests at several locations in several seasons.

ALFALFA

Following is a brief description of the alfalfa varieties included in this report (2).

Buffalo is a selection from Kansas Common. It was selected in Kansas for resistance to bacterial wilt as well as for seed and forage productivity. It has a bluish-purple flower and belongs to the common alfalfa group.

Ranger was developed in Nebraska. It is a multiple strain variety coming from wilt resistant selections out of Cossack, Turkistan and Ladak varieties. It is resistant to wilt and superior in winter hardiness. It has variegated flower color.

Atlantic has a complex background of many parent varieties. Developed in New Jersey, it is vigorous growing for 2 or 3 years. It is not resistant to bacterial wilt, although slightly more tolerant than Grimm.

Grimm is a variegated alfalfa introduced from Europe in 1857. It is known for cold resistance but is very susceptible to wilt.

Common alfalfa is usually distinguished by the name of the state where the seed is produced. It is susceptible to bacterial wilt. Different seed lots may show considerable variability. Common alfalfa seed produced south of Oklahoma is not sufficiently winterhardy for use in Ohio.

Narragansett was developed at the Rhode Island Experiment Station. It is quite winter hardy but is susceptible to bacterial wilt. It yields well for two years.

Williamsburg was selected out of Kansas Common by the Virginia Agricultural Experiment Station especially for resistance to ***Sclerotinia*** root rot. It is reportedly more resistant to certain leaf diseases than Kansas Common. It is susceptibile to bacterial wilt.

Du Puits, an introduction from France, is relatively vigorous in growth for two or three years or until affected by wilt or other diseases.

Vernal, a variegated, bacterial wilt-resistant variety, was developed at the Wisconsin Agricultural Experiment Station. It is equal or superior to Grimm in winter hardiness.

During the past 15 years 21 separate alfalfa variety tests were conducted at 8 locations in Ohio. Yearly hay yields were obtained 58 times from these tests. All varieties were not included in each test. In order to present comparable data for each variety, a comparison is made against Buffalo alfalfa as a standard. Buffalo appeared in each of these tests at all locations.

TABLE 1.—Relative hay yields of alfalfa varieties as affected by age of stand. Based on percent of Buffalo

Hay year	1	2	3	4	5	Average
Variety*						
Buffalo	100^{12}	100^{19}	100^{12}	100^{10}	100^{4}	100^{58}
Ranger	98^{12}	98^{18}	97^{12}	95^{10}	98^{4}	98^{56}
Atlantic	105^{11}	105^{15}	96^{12}	92^{9}	83^{4}	99^{51}
Grimm	98^{12}	99^{18}	90^{12}	69^{10}	72^{4}	90^{56}
Common	97^{12}	100^{19}	87^{12}	73^{10}	77^{4}	90^{57}
Narragansett	108^{5}	103^{5}	93^{3}	60^{1}	55^{1}	97^{15}
Williamsburg	109^{5}	106^{5}	108^{3}	69^{1}	--	105^{14}
Du Puits	104^{4}	97^{4}	100^{2}	63^{1}	48^{1}	93^{12}
Vernal	102^{2}	107^{3}	102^{1}	--	--	104^{7}

*Superscript indicates the number of tests making up the average.

Table 1 represents a summary of the data from Appendix Table I grouped according to age of stand or by hay-years. The principal factor influencing alfalfa yields and the choice of alfalfa varieties is susceptibility to disease. Bacterial wilt is universally present in Ohio. It may start to reduce the hay production of susceptible varieties after the second hay year. Buffalo, Ranger, and Vernal are wilt resistant varieties. When compared with resistant varieties as a standard the effect of this disease is clearly shown. Figure 1 illustrates graphically the decrease in yield of disease susceptible varieties such as Atlantic, Grimm, and Common[1] alfalfas compared with Buffalo and Ranger. Atlantic

[1]Common alfalfa in these illustrations represents either Kansas Common or Oklahoma Common or the average of both where possible.

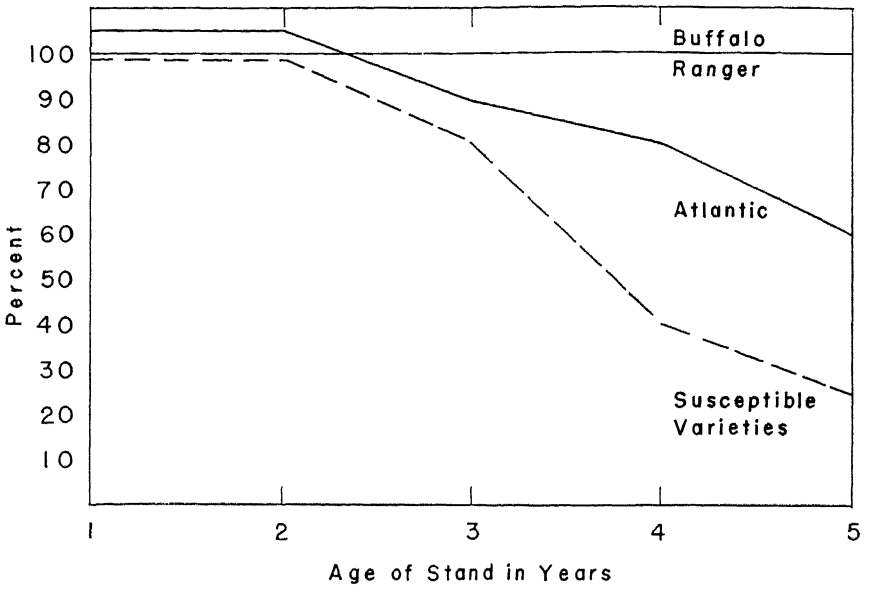

Fig. 1.—Relative yield of alfalfa varieties in tests where bacterial wilt became a factor. Susceptible varieties include Grimm and commons.

alfalfa is reported to be less susceptible to wilt than Common. Figure 1 indicates that this is correct.

Bacterial wilt does not always affect a variety test. In a field where the disease is present bacterial wilt develops most rapidly on wet poorly drained areas (5). An example of this is a four year old alfalfa variety test harvested at Columbus, Ohio in 1944. Twenty-two wilt susceptible varieties averaged 1.69 tons of hay per acre in one part of the test whereas the same varieties yielded 3.23 tons per acre in the remainder of the area. This difference was due almost entirely to bacterial wilt which was prevalent in the lower poorly drained portion of the area. The development of the disease is slow so that two good years of production may be obtained. The only control for bacterial wilt is through the use of resistant varieties.

Narragansett, Williamsburg, Du Puits and Vernal are newer varieties of alfalfa and have had only limited testing in Ohio. Vernal is the only variety of this group that is resistant to bacterial wilt. Therefore, it is the only one of this group that can be expected to maintain yields after the third hay year. When wilt is not a factor there appear to be

no important differences among any of the leading varieties. For the first two hay years it appears that Atlantic will outyield Buffalo and Ranger, however, this difference is small and the test results are not consistent.

RED CLOVER

Kenland red clover, developed in Kentucky, is well adapted to those areas where southern anthracnose is prevalent. It is the product of several years controlled selection under artificial inoculation with southern anthracnose.

Dollard is a synthetic of many red clover strains developed at Macdonald College, Quebec, Canada. It is resistant to northern anthracnose, a disease of the northern clover belt including northern Ohio.

Van Atta is a local strain grown for many years in southern Ohio.

Van Fossen is a local strain coming from central Ohio.

Midland red clover is composed of a composite of several outstanding old red clover strains. It carries some resistance to northern anthracnose but no more than adapted local strains.

Pennscott is a local Pennsylvania strain of superior yielding ability selected after tests at the Pennsylvania Agricultural Experiment Station.

Stevens red clover is an old farm strain grown for many years in Maryland. It has recently been named Chesapeake.

Mammoth red clover, often called single cut clover, is larger, coarser stemmed and later maturing than ordinary red clover, and does not make an appreciable second cutting. These characteristics make it undesirable as a hay crop in spite of its ability to yield well at first cutting. It is excellent for green manure, but no better than medium red for this purpose. It does not have a larger root system than medium red clover.

In the past ten years 20 red clover variety tests have been conducted in Ohio at nine locations. Most of these tests were conducted since 1951. Kenland red clover appeared in all of these tests and therefore will be used as a standard of comparison in this report.

As with alfalfa, disease is the main contributing factor influencing the selection of red clover varieties for a given area or use. Unlike bacterial wilt of alfalfa which occurs throughout Ohio, the principal diseases of red clover are restricted or influenced by latitude. Therefore, any consideration of red clover hay production by varieties must

take into account effects of latitude. For this report the results of red clover variety tests are calculated for the north and south half of the state. Southern Ohio includes that area on or south of U. S. Highway #40 with tests at Ohio State University at Columbus, Belmont County Experiment Farm, Madison County Experiment Farm, Hamilton County Experiment Farm and the Southeastern Substation in Meigs County. Northern Ohio includes the tests at the Ohio Agricultural Experiment Station at Wooster, Northwestern Substation in Wood County, Trumbull County Experiment Farm and the Mahoning County Experiment Farm.

TABLE 2.—Relative hay yields of seven varieties of medium red clover in southern and northern Ohio. Based on percent of Kenland

Variety	South		North	
	Hay yield	Number of tests	Hay yield	Number of tests
Kenland	100	16	100	13
Dollard	95	15	108	13
Pennscott	98	13	104	11
Midland	87	16	103	13
Van Atta	100	14	108	9
Van Fossen	95	15	108	11
Stevens	97	9	105	10

Relative hay yields for southern and northern Ohio are given in Table 2. Most varieties yielded more in northern Ohio than southern Ohio. Kenland, Pennscott and Stevens yield equally well in both areas. These differences are undoubtedly caused by several factors. Disease, especially southern anthracnose, may reduce yields of susceptible varieties in southern Ohio. Also much of the difference can be assigned to climatic and fertility effects. Figure 2 is presented comparing each variety against a standard variety. The standard in this case being Kenland which appeared in all tests at each location. Figure 2 clearly shows that in northern Ohio all varieties produced more hay than Kenland did in the same tests, while in southern Ohio all varieties yielded less than Kenland. For the southern half of Ohio this could be expected since all varieties other than Kenland carry a certain degree of susceptibility to southern anthracnose and various other diseases that periodically affect red clover production in southern latitudes. Southern anthracnose was serious at Columbus in 1949 and Pennscott pro-

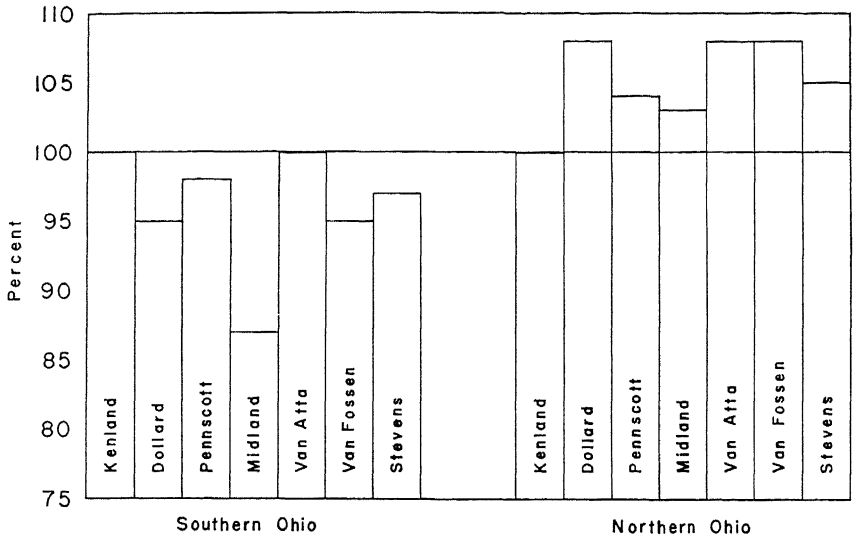

Fig. 2.—Data here compares yields of seven varieties in northern and southern Ohio. Kenland is used as standard.

duced markedly less than Kenland (Appendix Table II). Diseases of red clover are less prevalent in northern Ohio and a better expression of yield potential is obtained. It is of interest to note (Table 2 and Figure 2) that Van Atta and Van Fossen, local varieties of southern and central Ohio, outyielded all other varieties in the north half of the state. Van Atta is essentially equal to Kenland in southern Ohio.

SECOND CUTTINGS OF RED CLOVER

The amount of regrowth from red clover is determined largely by management factors. The differences between varieties in this respect are small unless diseases such as southern or northern anthracnose, or differences in leafhopper reaction, are present. In general the combined growths of the first and second cuttings will total almost the same as long as the first cutting is made sometime during the first three weeks of June. This subject has been thoroughly discussed in a previous publication (3).

Root diseases and insects also play a large part in the aftermath production of red clover. The clover root borer tunnels into and destroys the root. Root rot disease organisms can then gain entry into the plant and kill it (4).

CONCLUSION

Yield data from alfalfa and red clover variety tests since 1942 are summarized. These data give a good indication of what might be expected of the varieties when grown under the various climatic and soil conditions of the state provided recommended fertilization and management practices are followed. This is true both for forages in short rotations and for long time stands.

The alfalfa data indicate that bacterial wilt and other diseases can seriously reduce hay production of susceptible varieties after the second hay year. In tests where wilt was not a serious factor all varieties were yielding equally well in the fourth hay year. Considering the universal presence of bacterial wilt in Ohio it would be a needless risk to plant other than resistant varieties for long stands.

In these tests Atlantic alfalfa yielded about five percent more than the Buffalo-Ranger standard during the first and second hay year. It produces slightly less than the standard in the third year but declines sharply in the fourth and fifth hay year. Atlantic does not decline in yield the fourth and fifth hay year as rapidly as the varieties Grimm and Common which are highly susceptible to bacterial wilt.

Limited data are presented for the newer varieties Narragansett, Williamsburg, Du Puits and Vernal. Vernal, the only variety of this group with resistance to bacterial wilt, has given good production for three hay years at three separate locations in the state. Narragansett and Williamsburg appear to produce well for two and three years but based on the limited data of this report they do not appear better in this respect than Atlantic. Du Puits, a non-hardy French strain, is similar in production to Atlantic for the first two hay years.

Results of 29 red clover tests are reported. Tests from the southern half of the state are presented separate from the northern half to illustrate the effect of latitude and varietal interaction. Kenland, Pennscott and Stevens produced about equally well over the state with the latter two varieties favored over Kenland for northern Ohio. Other well known strains such as Van Atta, Van Fossen and Midland produced noticeably higher yields in northern than in southern Ohio. Yields of all varieties are compared with a standard variety, Kenland, which appeared in all tests.

It is of interest to compare the yields of higher yielding varieties and species with the 1.57 tons of hay per acre produced on 2,500,000 Ohio acres in 1954. Considering the results of these tests it is reasonable to assume that average hay yields for Ohio could be increased to two or more tons per acre by wise choice of variety, species and cultural practices. This would increase the annual supply of hay in Ohio by 1,250,000 tons on the present acreage.

When a farmer desires a new variety or a fresh seed supply of forage legumes the surest way to obtain it is to purchase certified seed. In general, certified seed is the highest quality of seed available for field crop production.

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APPENDIX TABLE I.—Yield performance of nine alfalfa varieties from 1942 to 1957 in Ohio. Recorded as percent of the Buffalo variety

Year of harvest	Year of planting	Varieties							
		Ranger	Atlantic	Grimm	Common	Narra-gansett	Williams-burg	Du Puits	Vernal
				Wooster					
1950	1946	90	83	79	66	----	----	----	----
1950	1948	89	104	97	98	----	----	----	----
1953	1951	98	108	103	100	----	----	----	----
1954	1951	98	100	99	100	----	----	----	----
1954	1952	107	106	107	103	----	----	----	----
1954	1953	109	117	101	100	107	111	113	114
1955	1951	98	109	94	100	----	----	----	----
1955	1952	107	100	100	103	----	----	----	----
1955	1953	110	109	102	103	107	102	106	113
1956	1951	95	71	65	66	----	----	----	----
1956	1953	96	101	94	101	106	99	107	102
Average		100	101	95	94	107	104	109	110
				Northwestern Substation					
1954	1953	92	95	93	96	----	----	----	----
1955	1952	92	95	83	92	----	----	----	----
1955	1954	102	101	----	95	----	----	----	106
1956	1952	102	105	96	100	----	----	----	----
1956	1954	106	119	----	103	----	----	----	**107**
Average		99	103	91	97	----	----	----	106
				Trumbull County Experiment Farm					
1952	1951	97	118	103	98	----	----	----	----
1953	1951	98	104	105	95	----	----	----	----
Average		98	111	104	96	----	----	----	----
				Mahoning County Experiment Farm					
1954	1952	91	85	97	98	----	----	----	----
				Columbus					
1942	1941*	97	79	97	107	----	----	----	----
1942	1941†	95	110	98	99	----	----	----	----
1943	1941*	111	103	82	112	----	----	----	----
1943	1941†	113	133	129	126	----	----	----	----
1944	1941*	102	71	102	93	----	----	----	----
1944	1941†	91	106	84	94	----	----	----	----
1945	1941*	140	77	29	65	----	----	----	----
1945	1941†	97	104	40	66	----	----	----	----
1945	1944†	105	----	120	108	----	----	----	----
1946	1944†	98	----	91	96	----	----	----	----
1947	1944†	86	----	64	56	----	----	----	----
1948	1944†	78	----	11	11	----	----	----	----
1949	1947	93	105	101	90	----	----	----	----

APPENDIX TABLE I.—Yield performance of nine alfalfa varieties from 1942 to 1957 in Ohio. Recorded as percent of the Buffalo variety—Continued

Year of harvest	Year of planting	Varieties							
		Ranger	Atlantic	Grimm	Common	Narra-gansett	Williams-burg	Du Puits	Vernal
					Columbus—Continued				
1949	1948*	98	118	97	88	115	123	----	----
1949	1948†	107	108	100	114	114	107	98	----
1950	1948*	89	112	100	89	89	116	----	----
1950	1948†	98	95	90	105	92	98	82	----
1950	1947	102	87	73	73	----	----	----	----
1951	1947	99	60	57	36	----	----	----	----
1951	1948*	92	96	85	83	87	107	----	----
1951	1950	113	114	115	92	99	129	116	----
1951	1950†	97	101	88	81	103	85	95	94
1951	1950*	83	97	87	101	----	----	----	----
1952	1947	95	60	40	32	----	----	----	----
1952	1950	112	118	113	96	106	120	110	----
1952	1950†	104	111	95	91	118	94	91	103
1952	1950*	84	100	96	101	----	----	----	----
1953	1950	106	119	104	99	91	113	96	----
1954	1950	96	85	90	95	84	95	88	----
1955	1950	86	71	65	82	55	----	48	----
Average		99	98	85	86	96	108	92	98
					Madison County Experiment Farm				
1952	1951	82	96	86	84	----	----	----	----
1954	1951	96	92	84	91	----	----	----	----
1955	1951	95	104	100	99	----	----	----	----
1956	1951	89	94	84	95	----	----	----	----
Average		90	96	88	92	----	----	----	----
					Hamilton County Experiment Farm				
1954	1952	90	95	93	96	----	----	----	----
1955	1952	84	72	89	88	----	----	----	----
Average		87	83	91	92	----	----	----	----
					Belmont County Experiment Farm				
1954	1952	89	98	95	95	----	----	----	----
1955	1952	97	98	98	96	----	----	----	----
1956	1952	94	94	93	94	----	----	----	----
Average		93	97	95	95	----	----	----	----
Average of all tests		98	98	89	90	98	107	96	106
Number of tests		58	54	56	58	15	14	12	7

*Observation nursery. †Advanced nursery.

APPENDIX TABLE II.—Yield performance of seven varieties of medium red clover in Ohio from 1944 to 1957. Recorded as percent of the Kenland variety

Year of harvest	Varieties					
	Dollard	Van Atta	Van Fossen	Midland	Pennscott	Stevens
			Wooster			
1948	116	----	113	97	----	----
1950	90	----	90	78	----	----
1952	98	107	103	86	96	102
1953	114	122	127	125	117	131
1954	109	109	100	108	93	----
1955	97	98	89	98	101	98
1956	115	100	116	106	96	109
Average	106	107	105	100	101	110
			Northwestern Substation			
1953	126	112	120	111	114	108
1954	99	119	111	118	113	97
1955	117	----	----	111	85	85
1956	111	----	----	108	117	122
Average	113	116	116	112	107	103
			Trumbull County Experiment Farm			
1953	92	94	99	104	107	87
			Mahoning County Experiment Farm			
1953	117	109	117	94	105	110
			Columbus			
1944	54	98	74	65	----	----
1946	121	96	93	94	----	----
1948	85	99	72	73	----	----
1949	100	----	113	48	70	----
1951	----	95	91	80	99	----
1952	98	99	88	110	123	103
1953	100	102	86	97	92	102
1954	100	99	94	99	97	----
Average	94	98	89	83	96	102
			Madison County Experiment Farm			
1953	104	108	96	102	96	90
1954	100	110	107	96	97	----
Average	102	109	101	99	97	90
			Hamilton County Experiment Farm			
1953	88	104	98	101	102	105
			Belmont County Experiment Farm			
1953	112	110	109	93	99	101
1954	91	95	88	92	87	88
1955	99	----	----	106	122	98
Average	101	102	99	97	103	96
			Southeastern Substation			
1953	77	81	102	95	96	99
1954	103	102	114	99	99	96
Average	90	92	108	97	98	98
Average of all tests	101	103	100	96	101	102
Number of tests	28	23	26	29	24	19